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This reports covers the **aerosol ocean** and **aerosol land** algorithm, the **NIR water vapor** algorithm and our involvement in the **fire algorithm**.

<u>Main topics addressed in this period:</u>

1. Lead Atmospheric Discipline Group in developing a joint QA plan. *(Chu)*
2. Participate in developing joint Atmospheric Group Version 2 file specifications *(Chu, Mattoo).*
3. Update water vapor code and ATBD. *(Gao, Chu)*
4. Analysis and documentation of the SCAR field experiment data: visual record of entire MAS data base completed; fire analysis software completed; AVIRIS targets analyzed for various optical thicknesses; trajectory analysis for Cuiaba; analysis of impact of smoke on column stability *(Kaufman, Kleidman, Li, Remer)*
5. Calibration, quality checking and analysis of data from laboratory experiment, in the Forest Service Fire Lab. with an CIA/John Hopkins Univ. instrument. *(Kaufman, Wald, Korb).*
6. Development of a new technique for remote sensing of dust over land using IR channels, to supplement present algorithm for remote sensing of aerosol from MODIS *(Wald ,Tanre, Kaufman)*
7. Surface properties in the mid-IR and the visible: paper accepted, autumn data collected over Charles County; preliminary analysis of CAR data*(Kaufman, Wald, Remer, Ji.*)
8. Continued validation of all algorithms *(Kaufman, Chu).*
9. Continued discussion of fire alarm and fire control products. *(Kaufman, Kleidman).*
10. Evaluation of MODIS cloud mask algorithm for use in aerosol algorithms. *(Ji, Remer)*
11. Sensitivity analysis on 3.8 µm channel. *(Chu)*
12. Planning begun for spring field experiment in Israel. *(Kaufman, Wald, Kleidman, Remer)*
13. Urban/Industrial aerosol paper: 2nd draft completed. *(Remer,Kaufman)*
14. Analysis of TARFOX data. (*Remer, Tanré, Li)*
15. Paper describing the MODIS fire algorithm (Kaufman, Justice, Menzel et al)
16. Analysis of the influence of the precipitable water vapor on the smoke-cloud interaction (Kaufman, Fraser), paper in preparation.
17. Integration of the software for remote sensing of aerosol over water and preparation for generation of the look up tables. (Ahmad, Mattoo, Tanre)
18. Completion of the JGR special issue on remote sensing of aerosol and atmospheric corrections.

<u>Topics postponed (or continued) to next quarter</u>

1. Submission of urban / industrial aerosol paper.
2. Look-up table generation for aerosol over land *(Chu)*.
3. Validation of water vapor algorithms *(Chu, Gao)*.
4. Look-up table generation for aerosol over ocean *(Ahmad, Mattoo)*.

Plans for the next quarter:

1. Analysis of the SCAR-B MAS data for fires, smoke, surface properties, clouds and total precipitable water *(Chu, Kleidman, Li, Remer)*.
2. Analysis of the fire lab data (Wald)
3. smoke aerosol model (Remer)
4. dust aerosol model (Tanre)
5. MODIS Atmosphere QA plan due in March, 1997 *(Chu)*.
6. Aerosol validation paper using SCAR measurements *(Chu)*.
7. Getting AVHRR LAC data for smoke-cloud interaction analysis

1. Atmospheric Discipline Group Joint QA Plan

The Atmospheric Discipline Group Joint QA plan includes general approach (run time and post run time) for quality assessment of the atmospheric products, and specifically the information content in the form of science data set and ECS core metadata for each atmospheric product. It will be due on March 20, 1997.

2. Version 2 File Specifications

The version 2 file specifications of level 2 aerosol and total precipitable water have been reconfigured to accommodate the joint product of aerosol over land and ocean, and total precipitable water of near IR and IR. The new configuration of each product includes geolocation, solar and satellite angles as a self-content data file.

3. Total Precipitable Water Vapor Code and ATBD

The total precipitable water vapor code has been updated to new version of ECS library code and accepted, which is now in the software integration. The ATBD of total precipitable water vapor has been updated to include comprehensive validation plan.

4. Analysis of the SCAR field experiment data

Analysis of the data set began in earnest with the delivery of the calibrated MAS data. 1) A visual record of all 11 flights was prepared. This enables quick determination of surface, smoke, cloud and fire conditions at any point in the flight track. 2) The automatic fire analysis software was completed. The algorithm detects fires and determines fire and background statistics. The algorithm will be applied to the entire MAS data base. 3) Targets were carefully selected from AVIRIS images and compared on days with very different optical thicknesses. 4) In collaboration with A. Thompson, D. McNamara and K. Longo we have analyzed the back trajectories from Cuiaba in conjunction with different fire, smoke, ozone and synoptic situations. The results should help us evaluate the smoke properties as measured in Cuiaba. 5) In collaboration with Y. Joseph we are analyzing radiosonde data looking for evidence that the smoke is affecting atmospheric stability. Preliminary results indicate a trend toward a significant de-stabilization of the atmospheric column. Papers were submitted to the Proceeding on SCAR-B.

5. Laboratory experiment at USFS Fire Lab

Laboratory experiment, in the Forest Service Fire Lab. with an CIA/John Hopkins Univ. micro-FTIR to test the relationship between remote sensing of fires and the emission of aerosol and trace gases from them. We collaborated with the ASTER group from JPL. Approximately 25 fires were observed. The instrument performed well and the in-house development of calibration techniques and the innovative signal reducing screen appear to have functioned properly, but are still being evaluated. Signal to noise ratios decrease significantly at longer wavelengths where emission from the signal reducing screen competes with signal from the fire.

6. Remote sensing of dust using IR techniques

The development of a new technique for remote sensing of dust over land using IR channels is progressing well. Retrieval of optical thickness is confirmed using ground-based sunphotometry for optical thickness less than 1.0 or greater than 1.0, but is less accurate when optical thickness is close to 1.0. Simulations have begun in order to test the observations against theory.

7. Surface Properties in the Mid-IR and visible channels

The aerosol land algorithm is based on the assumption that we will be able to determine surface reflectance in the visible channels from the reflectance at 2.1 μm. The method uses an empirical relationship between the two spectral regions. A paper detailing this empirical relationship was accepted by IEEE. We continue to check the empirical relationship by collecting spectrometer data over Charles County, most recently when the forest was in fall colors, and using the CAR instrument carried by the Univ. of Washington's C-131 aircraft.

8. Validation

A thorough validation of aerosol optical thickness derived by MODIS aerosol algorithm using SCAR measurements is scheduled to finish as a validation paper in the first quarter of 1997.

9. Fire alarm and fire control product from EOS-AM1

We are working together with the Forest Service Fire Lab. and U. of Montana on generation of a fire alarm and on the use of remote sensing data for fire fighting activities.

10. Evaluation of MODIS cloud mask

It is important that we choose the cloud mask tests that screen clouds without eliminating scenes of high aerosol optical thickness. The current evaluation of the cloud mask test suggest that the visible ratio test at 250 m resolution will be the primary determination of cloud for the aerosol algorithms. Evaluation of this hypothesis is being made using MAS imagery.

11. Sensitivity study of 3.8 μm channel

Sensitivity study of 3.8 μm channel (was originally centered at 3.75 μm) indicates approximately 50% error in the retrieved surface reflectance (assuming surface reflectance of 0.025) if using the uncertainties of MODIS surface temperature (~ 1°K), temperature profile (~ 2°K) and water vapor profile (~10%). The largest source of error is due to surface emission, which is directly related to surface temperature and emissivity. Because of 50 nm shift in spectral response, for surface temperature error >2°K the error associated with retrieved surface reflectance will be >100%.

12. Field experiment in Israel

In collaboration with A. Karnieli and A. Gitelson, we are planning a field experiment in Israel in order to increase our database of surface reflectance properties and to evaluate this empirical relationship in terms of canopy parameters such as LAI.

13. Urban/Industrial aerosol model

The paper detailing the urban/industrial aerosol model is nearing completion.

14. TARFOX data

Analysis of TARFOX data proceeds in two directions: 1) The AERONET network data is being compared to the SCAR-A data base. In general we find that TARFOX was generally less hazy and more regionally uniform than SCAR-A. However, the important characteristic of a dynamic accumulation mode increasing in particle size with increasing optical thickness dominates the TARFOX data set; thereby, supporting the use of the dynamic model in the MODIS land aerosol algorithm. 2) MAS imagery will provide a testbed for the ocean aerosol algorithm. MAS imagery is being prepared for that purpose. Several images and cross sections have been prepared. Although MAS calibration is still preliminary at this time.

15. Fire Paper

Second draft of the paper that describes the MODIS fire algorithm was finished. It is circulated to authors. The new draft includes a better energy determination and sensitivity studies. It includes also applications to South Africa. The paper is prepared by the MODIS extended fire science team: Kaufman, Justice, Menzel, Prins (NOAA), Ward (USDA-FS), Flynn (U. Hawaii) and Setzer (INPE)

16. Influence of precipitable water vapor on smoke-cloud interaction

In analysis of AVHRR data for smoke optical thickness and cloud properties, together with analysis of radiosonde data for precipitable water vapor, we found that the variability in the ability of smoke to influence cloud microphysics and reflectance is correlated with the availability of water vapor. We shall work on testing this hypothesis on other data sets. It can be also a basis for analysis of MAS data from SCAR-B and for analysis of MODIS data.

17. Integration of the software for remote sensing of aerosol over water and preparation for generation of the look up tables.

Detailed selection of pixels over the water for analysis for the aerosol properties over the oceans is implemented into the program. The program was also integrated into the SDST software. Tests showed the applicability of the strategy for generation of look up tables to the problem. we are about ready for the radiative transfer calculations for the V2 delivery.

18. JGR special issue on remote sensing of aerosol and atmospheric corrections.

The special issue is being completed with 27 papers, introduction paper, discussion paper and preface. It will serve the remote sensing community as a reference for the methodology used in remote sensing of aerosol and correction for their effects. The special issue is a result of a workshop held last April on the subject.

Problems, complaints

Too much fun work.